THE MAC Flyer

February 1986

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THE MAC Flyer

For Greater Safety in MAC Air Operations

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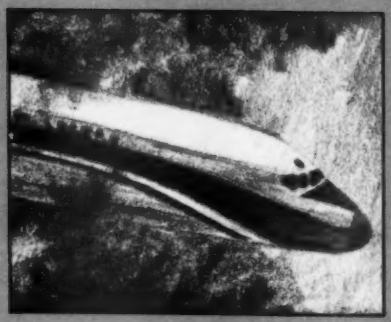

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The MAC Flyer is published by the Director of Safety, Military Airlift Command. The contents are informative and not regulatory or directive. Names of people and places in mishap stories are representative and not necessarily of the aircraft or equipment involved. Information in any article may not be construed as incriminating under Article 31, UCMJ.

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We Cannot Tell A Lie!

This month America commemorates the memory of many famous persons. We'll honor George (Can't Tell a Lie) Washington; Abraham (Honest Abe) Lincoln; and St. Valentine (we all know what he stands for).

Now is *your* chance to join this list of distinguished personages. All you have to do is jot down the details of just one of your hazardous, exciting, dramatic, funny or frightening missions in a pleasing, readable style and give it a flight safety punchline. Or, develop a fictional story with a flight safety message. Whichever one you choose, drop it in the mail in care of *The MAC Flyer* and you'll be off and running in the MAC Flight Safety Writing Contest.

If you win, thousands of MAC crewmembers will have your name on the tip of their tongue. Your name will be revered throughout the command. Why, Command Center duty officers might even treat you with the respect you deserve and probably give you any release you request. Billeting clerks may offer you the VIP suite the instant you walk in the door. The weather gods will surely favor you with clear skies and 100 knot tailwinds on each mission leg. Most important, you will receive a personal subscription to the world's number one flight safety publication (*The MAC Flyer*, of course) just for entering. The top three winners will receive an engraved desk set, and nine others will receive an engraved plaque.

Just read and follow the simple rules below and join the ranks of people forever famous. You deserve nothing less.

THE RULES

The 1986 MAC Flight Safety Writing Contest is conducted according to MACR 900-3 and these rules. All entries must be original, unpublished and postmarked no later than 31 March 1986. Stories must be between 1,000 and 3,000 words long (about 6 to 14 double-spaced typed pages). Poetry should be about 75 to 100 lines. Entries must contain an *aviation safety/mishap prevention message*. Manuscripts must be double-spaced, typed and submitted in two copies. Identify entries by title only and attach a cover sheet showing the author's name, address, duty phone number and unit. The cover sheet must contain a brief autobiography.

The contest is open to anyone. Entries qualifying under the above rules earn their author a free one-year subscription to *The MAC Flyer*. However, contest prizes (desk sets and plaques) may only be awarded to military members and civilian employees of the Department of the Air Force or Air Reserve Forces. Other entrants may be selected for Honorable Mention in a special category. All winning stories will be published in *The MAC Flyer*. Entries should be addressed to:

Flight Safety Writing Contest
HQ MAC/IGFE
SCOTT AFB, IL 62225-5101

Two Masks

Choose One

by Capt Thomas A. Farrier
Det 14, 67 ARRS
Keflavik NAS, Iceland

I confess I was a little leery of the flotation tank when my friends first suggested I try it. After all, I had seen *Altered States*, and am old enough to remember what happened to Wo Fat's sensory deprivation victims in one of the early "Hawaii Five-O" episodes. Still, the peer pressure was strong, and I was curious.

The attendants at the spa were very friendly, but they all had a somewhat secretive smile that unnerved me. Obviously, as a "rookie" they expected me to experience some new things. They were right.

I put on a pair of swim trunks, and in my eagerness to get on with the adventure ahead, nearly dove through the opening which led to my little tank. The spa manager was on hand to reassure me, and his parting words as the door closed were, "See you in an hour."

It wasn't too difficult to relax, once things got dark and quiet. For awhile, I was amused by listening to the gentle sloshing of the warm, epsom-salted water around me, waiting for my eyes to adjust to the darkness. It was very unpleasant to realize that my eyes *had* adjusted, and that my new little world was a very dark one indeed.

Something at the edge of my peripheral vision started to nag me. It seemed to be slightly to my right but vanished every time I turned toward it. I finally said to myself, "Well, this is supposed to be where I learn to master my consciousness or some such garbage. Why not find a way to get a good look at the source of this light?"

It proved to be surprisingly easy. The minute I completely relaxed and unfocused my eyes, the light snapped into focus. I rolled about a quarter-turn to my right, and found the source; a small, neatly lettered sign, similar to those in the London underground. It read "WAY OUT" and was posted over a hatch that I hadn't noticed before. Having had enough of "discovering myself," I was more than ready to bail out and get into something more enjoyable. I found the hatch handle, turned it, crawled out of my tank and went into the main room.

If I was still in the spa, someone had done some quick remodeling. A small, odd-looking attendant handed me a towel and a claim ticket, and announced, "Welcome, sir. Your body will be quite safe here until you are ready to leave." It was then I experienced the bizarre sensation of looking down at myself, still lying in the tank with a peaceful smile on my face!

The attendant remarked, "It isn't often that people find their way in here on the first try. You're welcome to make yourself at

Honorable Mention 1985 Flight Safety Writing Contest

home, but please don't try to leave the immediate area. There's plenty to do in here." The attendant then withdrew into a dark corner and I was left standing alone on the ivory-tiled floor.

The strangeness of my surroundings slowly dawned on me as I looked around. The receiving salon was lined with countless cubicles. In each cubicle, the primary furnishings appeared to be large, comfortable-looking easy chairs in front of huge projection television screens. As people passed through, they stopped at random and sat in front of a screen for a few minutes. I moved closer to get a better view of one such screen and was surprised to see an aircraft cockpit displayed on it. I wasn't familiar with the type, but there were two crewmembers in it and neither of them looked very happy.

An elderly man with a slight limp moved toward me with a welcoming smile. "Hello! Glad to see a new face for a change! Have a seat, and take a look at this one—it looks pretty grim, but they may get out of it yet!"

Puzzled, I nodded in agreement and moved into the vacant easy chair. My host settled in next to me with a comfortable sigh. Then I noticed another detail I hadn't seen before; two masks, the kind associated with the Greek theater, were hanging on the TV screen.

After welcoming me, the older man seemed content to leave me alone with my wild speculations on what was happening. I couldn't restrain my curiosity any longer.

"Where exactly am I, and what exactly am I watching?" I inquired with as much self-assuredness as I could muster.

The elderly gentleman turned abruptly and stared at me. "Quiet!" he hissed. "They're just about to make the choice!"

I returned my attention to the brightly-lit screen depicting the two distressed pilots. They were talking about fuel and an ominous-looking echo on the radar. They seemed to be trying to come to some decision about their route of flight. I couldn't hear them very well, but the old man next to me was glowing with pleasure.

"See! I knew this would be a good one!" he exclaimed. "They're going to continue through that whole line of showers!" In a calmer tone, he continued, "The AC's wife is eight months pregnant, and has had some complications along the way. The copilot has plenty of flying experience, but not in this type of aircraft. This flight will be interesting."

I could see the enroute chart on the AC's lap and gathered that the destination was well inland. There were two airports circled in pencil right on the coast, and the heated discussion seemed to center on a choice between a weather divert into one of them or press on to destination.

My older escort offered me what looked like an oversized remote unit, saying, "Here you are . . . pick one!" I took the box and was surprised to see the two masks on it. One grinned at me insanely while the other seemed full of despair. There was a button under each mask, and the man beside me urged, "Go ahead! Now's the time!" Without another thought, I pushed the one under the smiling mask.

The picture changed and I found myself looking at a split-screen shot of the AC and copilot. The AC was telling his relieved-looking wife about the flight ("Not too bad, y'know, but I wouldn't want to try it again!"). The copilot was in a dimly-lit lounge, drink in hand, saying to some concerned-looking friends, "I wouldn't want to try that again, *especially* with him!" The picture then cut to another split-screen shot of the same two men, several years later. There was no need to turn up the volume since both of them were saying exactly the same words . . . "Well, there we were at FL 270, with the weather coming down around our ears . . . ."

A chuckling, boisterous group of fellow flyers surrounded each man. Then the screen went dark.

My viewing partner rose, stretched, yawned, and started to leave. I shouted after him. "Wait! What does all this mean? What happened?"

He turned wearily toward me, straightened up a little and looked me over carefully.

"Oh, you're the outside fellow, aren't you? No wonder you're shaken." He paused a moment, trying to decide what to say.

"What you saw was real," he said softly. "In every decision, there are alternatives. We have chosen the ancient Greek concept of 'comedy' and 'tragedy' to teach us, and the occasional outsider, about the consequences of free choice."

"The two pilots were in a tough position. The man responsible for making the decision had pressures on him which affected his judgment. The copilot, though he had plenty of flight time, felt insecure because of his unfamiliarity with the new aircraft and his desire to trust the judgment of the aircraft commander. Together, they made a choice. You picked one of the two alternative tracks which stemmed from that decision."

"I pressed the 'comedy' button," I said thoughtfully.

"Indeed, you did," the other rejoined. "They lived. They came home with a good 'war story.' The tragedy of the situation was that neither learned from their experience. It just faded into their memories as a good story, rather than as an event which could have had a different ending. The copilot forgot his resolve to never again put himself in such a dangerous position. The AC just put the whole incident behind him completely, without a second thought. All good comedy is edged with irony," he concluded.

"What if I had pushed the 'tragedy' button instead?" I questioned.

He paused at the doorway, without turning around. "You would have seen the other possible result of flying through bad weather with incomplete information," he replied quietly. Then he was gone, and I was alone in front of the darkened screen. From other cubicles, I could hear countless other sounds of jet engines, urgent radio calls, and weeping relatives.

The small attendant was suddenly at my elbow. "Time's up, sir. Your regular place is waiting," the person said in an amusing tone. I looked down at myself, still lying there peacefully, but with the beginning of a thoughtful frown on my features. As I surrendered my claim check and slid into the cramped chamber, I recall having two thoughts: That I would never let outside pressures into the cockpit with me, and I'd best make a mental inventory of my own personal set of "war stories." The funniest ones may have had the makings of real "tragedies."

The last things I saw, as I groped to find the opening that would lead me back to reality, were the two masks. *Both were smiling.*

Captain Thomas A. Farrier is a 1978 Graduate of the Air Force Academy. After completing Undergraduate Helicopter Training at Fort Rucker, Alabama, he was assigned to the 703rd TASS, Shaw AFB, SC. In 1983 he arrived at Keflavik Naval Station, Iceland, where he currently serves as Chief, Standardization/Evaluation for Det 14, 67 ARRS.

Flying-Hour Milestones

SMSgt Wilburn E. Livengood, 156 TAS
MSgt Charles W. Thomas, 7 MAS

Col Daryl L. Bottjer, 39 ARRW/CV
Col Edward N. Brya, 39 ARRW/CC
Lt Col David F. Albrecht, 96 TAS
Lt Col Jon E. Hannan, 305 ARRS/CC
Lt Col Timothy H. Hatch, 15 MAS
Lt Col David E. Mullen, 304 ARRS
Maj Edwin E. Loomis, 96 TAS
Maj Robert J. McCullough, 14 MAS
Maj Richard L. Seymour, 57 MAS
Capt Richard J. Sette, 14 MAS
SMSgt Joseph J. Clay, 21 AF/DOV
SMSgt Henry K. Tanton, 310 MAS
MSgt Donald A. Cable, 310 MAS
MSgt Oliver King, 9 MAS
MSgt Jesse E. Rocha, 14 MAS
TSgt Mark S. Burton, 310 MAS
TSgt Alfred E. Roberts, 345 TAS

Lt Col James E. McArdle, Jr., 41 ARRS/CC
Maj Calfort M. Brownlee, Det 2, 67 ARRS
Maj Pinar Crane, Jr., 304 ARRS
Maj Clinton W. Hyde, 304 ARRS
Maj Waldo F. Libby, 304 ARRS
Maj William D. Peden, 304 ARRS
Maj John M. Poorman, 304 ARRS
Maj Dale B. Roth, Det 3, 1401 MAS
Maj Gregory N. Schneider, 305 ARRS
Maj Michael K. Sullivan, 304 ARRS
Maj James C. Woolworth, 305 ARRS
Capt Robert G. Mignard, Det 2, 67 ARRS
Capt Edward K. Saffer, 304 ARRS
Capt John R. Tapp, 1550 FTS
SMSgt Paul N. LeClair, 305 ARRS

Ranks and units are those at time of award. See MACR 900-3 for details on how to apply for your own milestone award.

Unexpected Consequences of

What we don't think about.

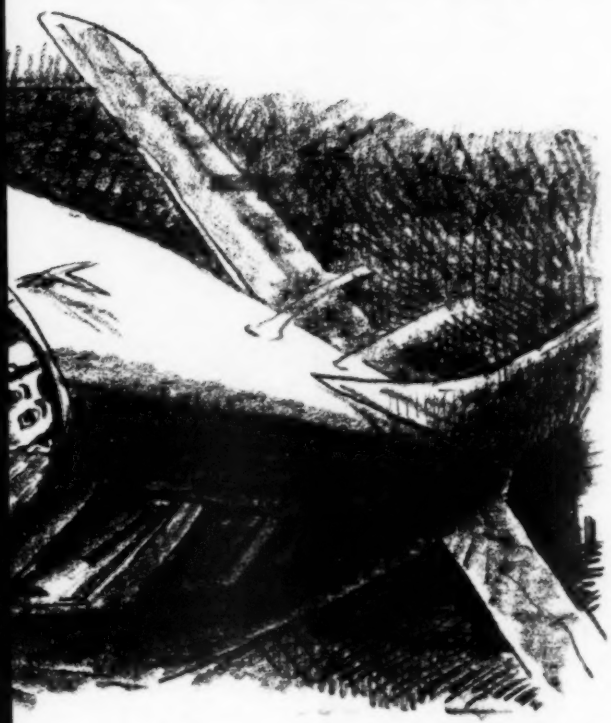
by Lt. Col. Ronald L. Godbey
HQ Air Weather Service
Scott AFB, IL

Aviation safety publications contain many articles dealing with weather which highlight situations resulting in aircraft mishaps or near misses. The moral to these stories reminds airmen of the hazards of icing, turbulence, lightning, wind shear, crosswinds, hail, altimeter errors, freezing rain, wake turbulence, and a host of other weather related phenomena.

Unfortunately, we continue to inadvertently fly into thunderstorms and hope we emerge from the other side in one piece. We make approaches in wind shear situations and hope we can respond quickly enough to avert disaster. Some of us have departed with ice on the wings and have bounced off bridges. Regardless of the technology engineered into it, an airplane may not be able to withstand or overcome the forces that nature and man places on it. We continue to put airplanes "in harm's way." They get banged up, crewmembers and passengers are injured or killed, and sometimes people on the ground are hurt.

In the normal course of events following a crash, relatives of the deceased are notified. There is a good deal of weeping; funerals are conducted; an accident board is convened; the debris is sifted, examined, and eventually cleared away. The accident board often concludes that someone—the mechanic, the controller, or the pilot—did something dumb. Somewhere along the line, even "old stormy" is called upon to assure that a good forecast was provided. At any rate, a lot of resources are involved. The loss of life, the cost of the airplane, the expense of replacing trained personnel, settlements for dependents and relatives, ground damage claims, etc., all add up.

Doing Something Dumb



These are some of the *expected* consequences of doing something dumb; but what about the *unexpected* consequences? Let's examine a few situations and, with apologies to the famous journalist and commentator, Paul Harvey, get the "rest of the story." Each is a factual account of a real incident. Only the names and places are changed to protect the character and memory of the deceased. (We all want to be remembered as the aeronautical daredevil who coolly and heroically stayed at the controls of our flying machine, and not as the dimwitted nincompoop who defied all sound advice, placed the machine in jeopardy, killed himself along with his passengers and crew, and destroyed $30 million worth of property).

The first example demonstrates the unexpected consequences of not following the rules. It involves a Texas businessman we'll call Sam. Sam was relatively successful. He owned several retail stores in Austin and San Antonio. His financial statement showed his net worth was over $5 million. Sam purchased a light twin-engine aircraft complete with autopilot and other "gee-whiz" gadgets. Sam decided to fly his wife and their two best friends to Las Vegas for the weekend in the twin. The Austin forecast predicted showers and thunderstorms as far west as Fort Stockton. Unfortunately, Sam never made it that far. The investigation revealed that about 10 minutes out of Austin, the twin emerged from a low overcast, nose down, with both engines at full power. The crash was not survivable.

Now, the expected consequences of flying into a thunderstorm are at the least, bruises, and at worst, death. The following, however, are the unexpected consequences: The surviving children of the passengers filed suit against Sam's estate. "So what," Sam might have said had he lived. "I carry plenty of aviation and negligence insurance; if I hurt someone, my insurance company will take care of it." Sam's insurance company didn't view his unprofessionalism so charitably. They denied coverage. It seems Sam had filed an IFR flight plan, but had not yet been awarded an IFR rating. From the insurer's viewpoint, this violated terms of the policy and voided the insurance contract. The insurance company was not obligated to pay. The court upheld the insurance company's position in spite of testimony from Sam's instructor indicating Sam was a competent IFR pilot, had passed the written portion of the IFR rating, and was only awaiting a checkride, which the instructor was sure Sam would pass.

What were the other unexpected consequences of Sam's folly? The children of Sam's best friend now own Sam's stores, house, cars, bank accounts, and other assets. What happened to Sam's children? At last report, they were living with grandparents and other relatives in rather austere circumstances, with very little hope for the bright future Sam could have provided had he lived. The unexpected consequences can be devastating for those whom we least wish to harm.

Let's look at another general aviation

case, this one not weather related. It seems that one frosty morning, Doc Wickam could not get his airplane's engine to crank (dead battery). So, Doc asked a friend and fellow aircraft owner to hand prop the engine. Doc's friend called for the magneto "switch off." Doc responded with the traditional "switch off." Unfortunately, he left one of the mags hot. You can guess the rest. The engine started, the prop hit Doc's friend and killed him instantly. The heirs brought suit against Doc. Now they own Doc's airplane, virtually all of Doc's assets, and a substantial part of Doc's medical practice income for many years to come. Now, you can expect that allowing someone to turn a prop with a hot mag will lead to injury or death. The unexpected consequence, however, is bankruptcy. By the way, Doc's insurance did settle partially with his friend's survivors. Doc just didn't carry enough insurance to satisfy the entire judgment the jury returned.

But let's get back to weather to further demonstrate the folly of fooling with "Mother Nature." Our third example relates to a hot-shot pilot by the name of Walter. Walt rented a Bonanza in Little Rock, filed a VFR flight plan, and departed for Oklahoma City. Walt later said he knew the enroute forecast called for numerous thunderstorms along his route, but that he was going to "go out and take a look." He picked his way through and around thunderstorms until he reached the Eufala Lake area in eastern Oklahoma. There he saw "a solid line of thunderstorms." Not being anyone's fool, he did the smart thing and reversed course. After reversing direction, Walt was amazed to find he was flying in the only VFR "hole" in eastern Oklahoma . . . and the "hole" was getting smaller. Walt elected to land, wheels up, in a melon field. His injuries were slight; but the aircraft was virtually destroyed and he broke a lot of melons.

Now, the expected consequences were perhaps to be shaken up a bit, the cost of a few melons, and the cost of the Bonanza, which was probably insured. As a matter of fact, the aircraft was insured and the company paid the owner for the airplane. Then they came after Walt. That's right, the insurance company sued Walt for the costs they incurred in satisfying claims by the aircraft owner. It's called subrogation. At the trial, the insurance company put on lots of testimony from meteorologists about the forecasts and weather warnings. They also had experienced pilots testify that it was real dumb to be flying in eastern Oklahoma that day. The jury agreed. The unexpected consequence of Walter's folly was a judgment against him for the cost of a Bonanza, a melon patch, and a lot of attorney's fees.

If you fly military aircraft exclusively, and are involved in an incident of one degree or another, you may not be facing the prospect of personally defending a suit brought against you in civil court. This is because the U.S. government will take the heat regarding property damage and compensation for loss of life or injury.

However, your memory might call to mind some unexpected consequences of doing something dumb in the cockpit of a military aircraft. Landing with the gear up or departing with a control lock installed will probably have a career-limiting impact. Carrying it a little further, what commercial carrier would be seriously interested in a former military aviator, who, on one occasion, managed to ignore all sound advice, checklists and blaring horns, and landed with the wheels still in the well? Could unexpected consequences include the end of your aviation career? Could it have a financial impact upon you and your family?

Suppose things really go bad and there are casualties . . . and you are one of them. Personally, you are beyond the reach of safety investigation boards, civil courts, or even your DO. Will there be any unexpected consequences for your family? What about their future? How about finances? Think about it!

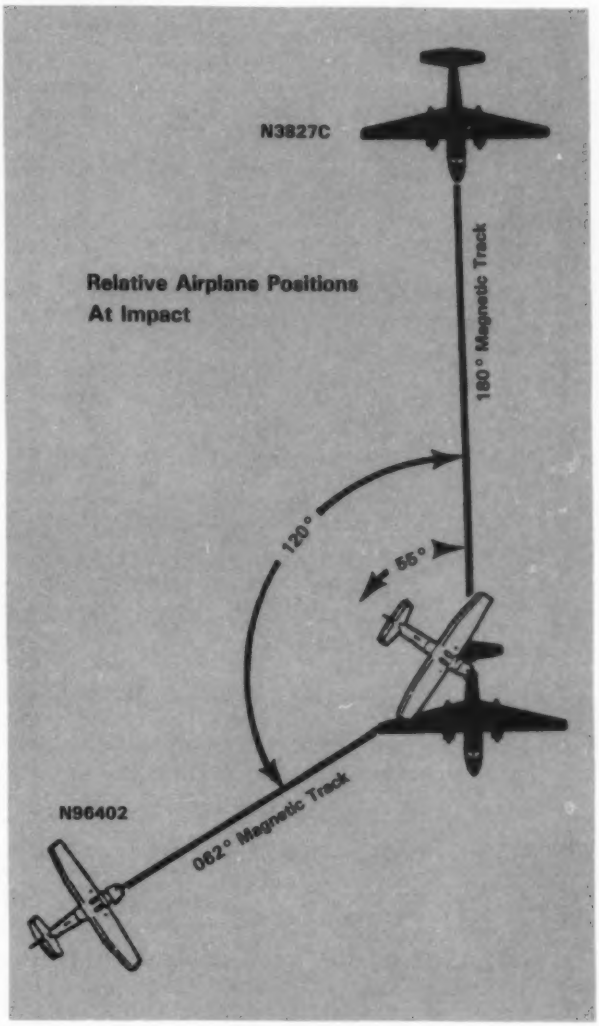
Lt. Col. Godbey is an Air National Guard officer on extended active duty as Reserve Forces Advisor to the Commander, Air Weather Service. Prior to accepting this tour, he practiced aviation law in Texas for ten years. He has a law license from Texas and Illinois and is listed in Who's Who in American Law. He is also a certified Consulting Meteorologist and holds a private pilot's license with the FAA.

What happens if you don't maintain... Adequate Vigilance

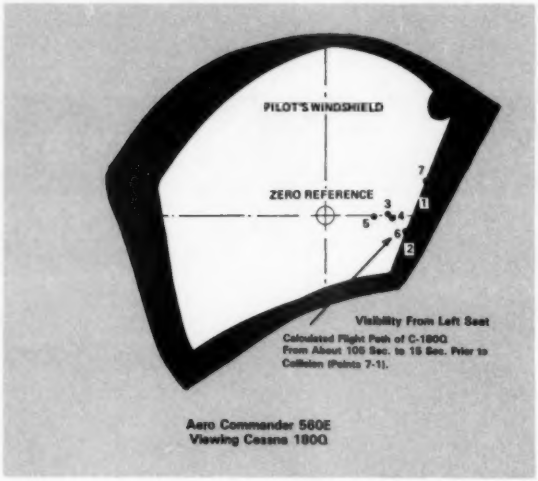
The human eye is a very high-tech device, capable of detecting an object as small as .02°, or 1 minute of arc (under static conditions with 100% contrast). Our eyes are so good that we define our world largely by what we see. A verbal description of a situation at odds with our visual perception is quickly discarded in favor of a more "dependable" occular impression. In November 1982, the pilot of a North American Rockwell Aero Commander 560E and the owner-pilot of a Cessna 182Q confronted the frightening reality aviators face when the unforgiving "see and avoid" precept fails.

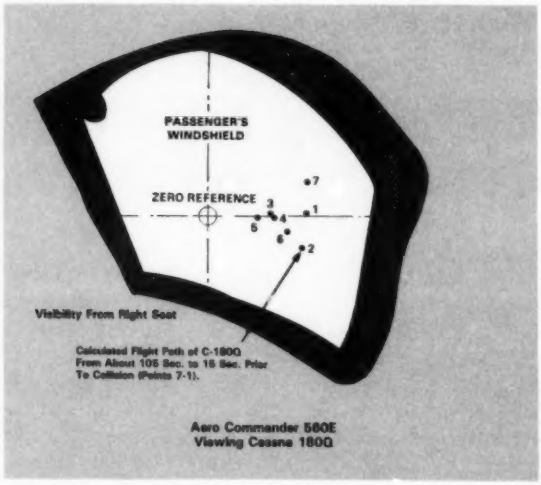
On 20 November 1982, the pilot of a Cessna 182Q, N6402, prepared for a 1600 Eastern Standard Time takeoff. He planned a VFR flight from Kupper Airport, Manville, New Jersey, direct to Romapo Valley Airport near Spring Valley, New York. The Cessna was equipped with a 4096-code transponder without mode-C capability. The pilot didn't file a flight plan, and made no contact with any FAA facility during his flight, although his aircraft was equipped with a two-way radio. The route of flight took him through the New York Terminal Control Area (TCA), touching the perimeter boundary where the TCA floor drops from 3,000 to 1,800 feet. The pilot of the Cessna had flown this direct route several times. This would be his last.

At about the time the Cessna 182Q was taking the runway at Kupper Airport, N3827C, a Rockwell Aero Commander 560E, was taking the runway at Teterboro Airport, New Jersey. Earlier this mild November morning, the owner of N3827C flew his white with blue trim, high-wing monoplane to Blairstown Airport, New Jersey, for some repair work. The repairs went smoothly, and the pilot/owner invited a friend to ride along on the trip back. They took off for Teterboro under VFR in VMC. The pilot didn't file a flight plan. Eight minutes after takeoff, he



contacted the New York Terminal Radar Approach Control (TRACON), and requested a practice ILS approach to Rwy 06 at Teterboro Airport. The controller asked 27 Charlie for his position, and the pilot answered "about seven miles southeast of the


PILOT'S WINDSHIELD
ZERO REFERENCE
Visibility From Left Seat
Calculated Flight Path of C-180Q From About 105 Sec. to 15 Sec. Prior to Collision (Points 7-1).
Aero Commander 560E Viewing Cessna 180Q


PASSENGER'S WINDSHIELD
ZERO REFERENCE
Visibility From Right Seat
Calculated Flight Path of C-180Q From About 105 Sec. to 15 Sec. Prior To Collision (Points 7-1).
Aero Commander 560E Viewing Cessna 180Q

Sparta VOR." The controller assigned the propeller-driven aircraft a discrete transponder code and the pilot set it in correctly. The controller identified the aircraft one mile west of Moree radio beacon and informed the pilot he was in radar contact, advising him of the current altimeter setting. The controller then directed a 170° heading.

The pilot acknowledged the new altimeter setting and the heading change. At 1611 EST, the controller read out N3827C's mode-C signal as 1,900 feet, which the pilot confirmed, transmitting "We are right now at two point oh (sic)." Since 2,000 feet is the minimum authorized altitude to intercept the ILS localizer for that approach, the controller responded "Okay, maintain 2,000 feet, numerous targets in your 12 o'clock position . . . ." The pilot of the Rockwell Aero Commander responded to the warning "Roger, that's Caldwell Airport." At this point, however, Caldwell Airport would actually have been in N3827C's 9 or 10 o'clock position. At 1612, the pilot of N3827C identified his aircraft type to the controller. This was the last transmission the controller received from him. At 1614 the signal from an emergency locator transmitter (ELT) sounded in the New York TRACON. The Cessna 182Q and the Aero Commander 560E collided, killing the occupants of both aircraft.

ANALYSIS

The analysis of this midair collision began by identifying the qualifications of the personnel involved. National Transportation Safety Board (NTSB) investigators determined both pilots were properly certificated to operate their aircraft. The air traffic controller was fully rated under Federal Aviation Administration (FAA) authority. Investigators also ruled out any in-flight malfunction or structural failure prior to the collision.

Witnesses confirmed the Cessna made a sharp turn just prior to impact, but couldn't confirm in which direction. Careful examination of the wreckage and impact sites revealed the collision angle of the two aircraft. The Cessna was flying a magnetic track of approximately 062°, while the Aero Commander was flying a magnetic track of approximately 180°. This results in a relative angle of approximately 120°. This angle would appear to afford the pilots of both aircraft ample opportunity to "see and avoid." Analysis showed the closure rate was about 400 feet per second, or 236 knots from 75 seconds before impact, when the aircraft were separated by some 5.7 miles, until impact. The initial contact was between the right wings of the two aircraft.

The evidence revealed that following initial impact, the nose and propeller of the Cessna 182Q hit the empennage of the Aero Commander, separating the tail from the fuselage. The right side of the fuselage, in the separation area, had red paint marks similar to the red paint on the surfaces of the Cessna. The vertical fin of the Aero

Commander was found battered and torn. The left horizontal stabilizer, which separated at its base, had cuts which looked like propeller slashes. The Aero Commander impacted in an inverted position.

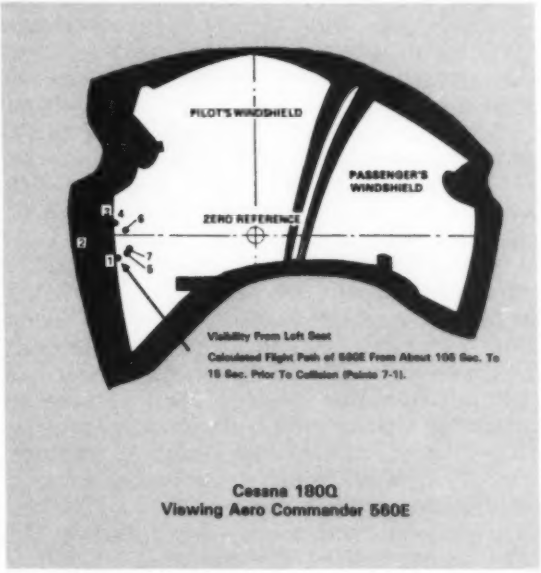
The Cessna, in comparison, reflected very little damage indicative of a midair collision. The right wing was extensively battered, and the left wing was consumed by fire. The lower skin of the nose cap assembly and the left cowl flap had blue paint marks which matched the blue-painted surfaces of N3827C.

The Cessna pilot's preflight planning, or lack of it, set him up for traffic problems. The Cessna's plotted course left no margin for dead-reckoning navigation error to ensure the aircraft would remain outside the TCA airspace unless the pilot flew through the area well below 1,800 feet. The "Airman's Information Manual (AIM), Basic Flight Information and ATC Procedures," an FAA publication, states: "Regardless of weather conditions, ATC authorization is required before a pilot may operate within a TCA, and pilots should not request such authorization unless their airplane is equipped with a two-way radio capable of communicating with ATC, a navigation receiver, and a 4096-code transponder *with* mode-C automatic altitude information in 100-foot increments." The AIM continues, highlighting the known danger of proximate controlled and uncontrolled aircraft, stating: "VFR, non-TCA aircraft are cautioned against operating too closely to TCA boundaries, especially where the floor of the TCA is 3,000 feet or less or where normal VFR cruise altitudes are at or near the floor of higher levels. Observance of this precaution will reduce the potential for encountering a TCA aircraft operating at TCA floor altitudes."

The Aero Commander pilot made radio transmissions until just a few minutes prior to impact. The Cessna pilot, however, wasn't in radio contact with anyone. The safety board concluded that if the pilot of the Cessna had been in radio contact with the controller, timely traffic advisories may have prevented the mishap. The safety investigators also believed that contacting the controller would have alerted him to the situation. He might then have observed the radar returns and noted the collision possibility. The board paid special attention to finding the reason the controller failed to see the Cessna's return. The Cessna *was* equipped with a transponder, albeit without mode-C, and it *was* transmitting the VFR code 1200.

The NTSB noted that the recorded ATC radar data provides evidence the N96402 target was also present on the controller's display, yet the controller never recognized or perceived it as potential traffic for the aircraft he was working. The NTSB believes the controller could and should have observed the potential conflict and issued an appropriate warning. The Board couldn't determine why the controller failed to recognize the potential conflict along the edge of the TCA. They concluded the collision potential was evident before either aircraft crossed the horizontal TCA boundary. While this oversight significantly reduced the safety margin built into flight operations, it wasn't the only problem.

FAA rules specify that each person operating an aircraft under visual or instrument flight rules, regardless of type aircraft, will see and avoid other aircraft. In this mishap, there was no reason for this not to happen. The sun position and weather wouldn't have hampered their views of one another. The Board is aware that even though a pilot is regularly scanning for traffic, it is possible for him to be distracted at critical times by chart reading or other


PILOT'S WINDSHIELD
PASSENGER'S WINDSHIELD
ZERO REFERENCE
Visibility From Left Seat
Calculated Flight Path of 560E From About 105 Sec. To 15 Sec. Prior To Collision (Points 7-1).

Cessna 180Q
Viewing Aero Commander 560E

at critical times by chart reading or other cockpit duties. The pilot of the Aero Commander may have also fallen victim to the tendency to allow technological "eyes" to provide an envelope of safety around him—after all, he was in "radar contact."

An analysis of the collision geometry revealed there were 107 seconds available for the two pilots to see and recognize the other's aircraft. There were, however, factors which impacted each pilot's ability to detect and identify the other. The Safety Board pointed out that the limitations of human sight influence this task greatly, and explained why targets go undetected even though they appear in the pilot's field of vision. The limitations which may have affected the pilots in this mishap include:

- Minimum Visual Acuity: The smallest detail the human eye is capable of resolving at a specified distance.
- Conspicuity: The contrast between a target and its background.
- Motion Sensitivity: Peripheral vision is sensitive to motion; that is, the eye will sense motion and trigger appropriate eye and head movements so an object in the peripheral field of view can be viewed clearly.
- Empty Field Myopia: When searching a homogeneous field, as when flying on a hazy, overcast day, over water or snow, at night or at high altitudes, the eyes tend to relax their focus to a distance *within the cockpit*.
- Blind Spot: A defect in the eye where the optic nerve attaches to the retina. It is normally compensated for, as one eye can see objects in the other's blind spot. A problem arises when objects are viewed monocularly, or are located near obstructions at angles of 45° or more. The only way to fix this problem is to turn the head so the field of vision is always within 45°.

In this accident, the collision angles would make the targets for each pilot relatively small. A cockpit visibility study revealed that during the final 45 seconds, N96402 was in the Aero Commander pilot's monocular field of view due to the windshield center post. The Cessna pilot had a monocular view of the Aero Commander until 15 seconds prior to impact, when the aircraft entered the Cessna pilot's binocular field of vision, thus the late evasive maneuver. During the 107 seconds before the collision, while the distance between the aircraft closed from a range of about 7.76 miles , the passenger in the Cessna had the image of the Aero Commander in *full view near his zero eye reference.* The Safety Board concluded had the passenger been looking for other planes, he might have seen the aircraft in time to avert the collision. Further, both pilots would have had the other in full view by leaning forward as they scanned.

PROBABLE CAUSE

The NTSB determined the probable cause of this mishap was the failure of the pilots to exercise adequate vigilance to detect and avoid each other. In presenting this cause, the Board noted the limitations of human vision and the inherent difficulties in perceiving, recognizing, and effectively avoiding a collision. Contributing to the mishap was the Cessna pilot's failure to keep clear of the New York TCA or take advantage of the available traffic advisory service. Also contributing was the failure of the controller to observe the potential traffic conflict and adequately convey traffic information to N3827C.

APPLICATION TO MAC

The majority of our flights are conducted under IFR, regardless of weather conditions. This makes us even more susceptible to the overconfidence the words "radar contact" elicit. The need to "see and avoid" is mandated by regulation, and reinforced through knowledge of the consequences of its failure. MAC crewmembers are also victims of the same defect in the human visual system that these pilots were. Scanning is difficult enough over long flights, without the built-in handicap of not being able to see what we're looking at. But the most striking lesson we, as multi-person aircraft operators, can learn from this tragedy is the result of relying on one person to clear for traffic. We have more than one crewmember in the cockpit for a very good reason, and the MAC 55-XX series spells it out, mandating an "outside observer" below 10,000 feet. The other crewmembers *must* take an active role in scanning for other aircraft, and not just after the controller has called traffic . . . .

Adapted from NTSB/AAR-83/03

Live and Learn

by Maj. Michael G. Luckenbach
21 AF/SEF
McGuire AFB, NJ.

Something to think about.

As I sat staring out the window on a warm afternoon trying to come up with answers to some recent aircraft mishaps, I was interrupted by a lieutenant who strolled into the office.

"I want to file a hazard report," he said.

"Fine, what's the hazard ?" I asked.

"Attitude," he replied.

I looked at him quizzically, waiting for more. When he didn't speak, I told him he would have to be more specific.

He sat down, looked me straight in the eye and once more said "attitude." He said he believed the wrong attitude caused most mishaps and that he once had an attitude problem: *over-confidence*.

Noting his rank and the spotless flightsuit he wore, I said, "It's not unusual for someone right out of pilot training to think they could show Steve Canyon how to fly."

"That's not what I mean," he interjected.

"Okay," I replied, "what *do* you mean?"

"You're right, it wasn't that long ago when I earned my wings. I felt I knew my stuff, but then I got into a different airplane. I began learning an entirely new mission, flying with people with more experience and skill. I tried to keep my mouth shut and learn as much as I could."

"Sounds commendable so far," I said.

"Yes, well, that's where the over-confidence starts. You start flying missions and you start to get to know your fellow crewmembers pretty well. I'm always impressed with the way my AC flies the airplane, always cool in emergencies, can land on a dime. Every once in a while he might get in a tight spot, but whatever the problem he can always fly out of it. The AC said he knew the limitations in the Dash-One were inflated with safety margins and knew he could get more out of the airplane than they suggest. It was really great flying with a pilot who knew the airplane and flew it well. He always seemed to be on top of things."

"Why are you speaking of your AC in past tense?" I asked, noticing some shakiness in the lieutenant's voice.

"I'm getting to that," he replied. "All I had to do was sit back, wait for instructions and enjoy the mission. To me and the rest of the crew, the AC could do no wrong. This was always the case, until the night we were finishing the next to last leg of a long mission. As a member of the crew, I should have said something, but we had been in this kind of situation before. We were flying down through the weather, looking for the runway and sneaking a little bit below minimums. We thought we could see the runway lights when suddenly we saw a group of trees, the AC yanked back on the yoke and put in the power but we still clipped some of the branches . . . . Anyway, that's why I want to put in a hazard report about attitude, about depending too much on the expertise of your fellow crewmembers and not speaking up when you should. That's probably all the AC needed to knock off the approach and go around."

"I see your point," I answered, "but I don't see how you can file a hazard report on your own attitude, unless you think it's pretty common."

"I don't know. You're probably right," the lieutenant said. "I really just wanted to get the story off my chest."

The lieutenant got up and started to walk out the door. Offering a little consolation I said, "Hey, live and learn." He turned, smiled, and with a parting wave, went on his way.

As I sat back and started to pick up my former train of thought, something about the lieutenant's story struck me as being familiar. It didn't take long to locate it in last year's mishap file. The crew had ducked under the weather, while apparently looking for the runway. The aircraft hit some trees and crashed. The report went on to say the aircraft was totally destroyed, *no survivors*. Probable cause—aircrew error.

C.R. TERROR

The Courageous Cargo Carrier Supervises an ERO

"Engineer, loadmaster. How about throwing a couple more logs on the fire, it's getting pretty chilly back here," Ty Downs shivered.

"Roger, load, coming up," Max responded cordially. "This is one of the coldest days I can remember. Didn't think we'd make it 'til enroute maintenance got that cart started."

"Yeah, we've got a real sharp crew chief, but how'd you like to have to work his shift? He was out working this bird most of last night," Blinky added. "He's exhausted. I sure hope he's resting well there on the bunk."

"Speaking of shut-eye Blinky ol' bean, I certainly could have used a little last evening. Yes m'lads, these deployments test the ingenuity, creativity and perseverance of us all," started the Sultan of Sympathy. "Why, my own thermal comforter wasn't functioning properly last night. Crimenently, the temperature in my room dropped down to nearly 75° *twice*. I wasn't sure I'd be with you this morning."

"Uh, Boss, I think we'd better check in with the ALCE at Swann. They're *very* interested in our airdrop today. These special forces are part of a high-visibility exercise, you know," Sammy said, turning the conversation back to reality.

"Right you are, Sammy. Blinky Ol' Bean, what's the latest takeoff time to join the formation? Max, when do we start the combat entry checklist? Ty, how's that one-minute warning coming? We'd better keep things rolling here; we don't want to get caught behind the power curve you know." The Learned Low-level Lothario loved the details of airdrop.

"Uh boss," the ready right seater began, "We have to pick up our load

at Swann AB first, *than* we can start the low-level route."

"I know that. Ah yes. Swann Air Base, home of the original green cuisine. I remember it well," began MAC's most Experienced Extractor. "Why, even ol' Windsock remembers those wonderful midnight meals with Col Fang at the 'Burnum Burger.' Every time I mention those finely aged french fries and carefully cultured omelets, he goes into cardiovascular convulsions, the memory of those digestive delights is too rich for him."

"Uh Boss? Don't you think we ought to start the briefing?" Sammy inquired. "We've a fairly complicated mission today. To start with, we're supposed to be ready for a quick-turn, engines running onload. There are some H-3s inbound to Swann and they have priority, so if we don't want to get stuck there, we'd better be ready when we arrive."

"I'm gonna need some help in the back," Ty Downs, the Magnificent Major's trusty loader of cargoes responded. "Looks like I'm going to have to do some rigging, too. Seems the number of jumpers we'll be picking up exceeds the number of seats we've set up."

"No problem, I'll personally come back to help," C.R. announced. "It's been awhile since I supervised an ERO."

"You mean since that time you motioned them to drive the tank up the ramp before it was completely lowered, and we taxied 400 yards under tread power?" Sammy remembered.

"As I was *saying*," the Confident Cargo Compartment Crusader glowered. "After everything is secure up here, I'll pass control to you, Samuel m'lad. Then I'll head back. Blinky, you'll be . . ."

"In position at the base of the stairs, Boss," Blinky said, readying himself for the inevitable. "By the way, please don't forget to switch over to PA. Remember when we tried to brief the Air Force IG via hand signals over the noise of the racing engine of a deuce-and-a-half, only to confuse the driver and have him drive through FS245?"

"Gentlemen, please," the Deluxe Driver of Dignitaries pleaded. "The driver shouldn't have been watching up front anyway. And anybody could have inadvertantly strapped down the Colonel instead of his baggage. After all, they were side by side and I was in a hurry. No harm done. He even said he'd *personally* monitor our career progress from that day forward. And you guys thought only golden boys got sponsored."

"Right Boss," Sammy sighed, recalling how his last OER mysteriously closed-out at the Squadron. "We've no career problems anymore."

"Think nothing of it m'lads. Consider it my legacy to you. Now, as I said, I'll be in the back working the ramp, Ty, which will free you for the more creative rigging requirements. If there are no questions, we'll consider the briefing complete. Before takeoff

checklist, engineer, if you please."

"That's 'before landing' boss, and I think we'd better brief the approach, too," Sammy interjected. "This airfield has changed some over the years. They have a recently constructed dirt assault strip right alongside the main."

"What change, Samuel M'lad?" C.R. began gently twisting the gold-ring Egyptian Oval in the cigarette holder dangling from his lower lip. "The last time I was in here, all they had was a dirt strip. As for the approach, it will be visual of course, terminating in a gentle but solid touchdown in the famous box."

With that, the Master Manipulator gently, but firmly, pirouetted the hearty Herk through 90° and aimed it at the rapidly approaching dirt field. Sammy, Max, Blinky and Ty, already securely strapped in, braced for the impact of a lifetime.

"Contact ALCE, Sammy m'lad and let 'em know we've landed. And while you're at it, give Ty a call and let him know as well. No sense keeping him in suspense forever." C.R. had a way of subtly letting his crew know when he'd done something which pleased him.

"Nice landing, Boss," his crew responded with the stereophonic clarity of a laser disc player.

"ALCE, SHINDA 54. We're on the deck and taxiing to the onload area."

"Roger, 54. We've got our folks ready to marshall and load you. Whatever you need, they can handle."

"Roger," the Efficient Right Seater responded. Not missing a step he pointed out, "Boss, we've got our marshaller straight ahead, and off to the right there's one more guy."

"I hope there's more than just one," Ty commented concernedly. "I'm going to need them to get these extra parachutes off in a hurry."

"Not to concern yourself, Ty m'boy. I'll be in the back and besides, the marshaller can help if necessary," the King of Calm soothed.

"I don't know, Boss," Ty continued. "It takes more than a quick 'be careful' to train somebody on ERO procedures. I've seen 'em get pretty caught up in trying to get things done in a big hurry . . ."

"We'll keep em straight, Ty ol' bean, you just get those seats rigged, and leave the loading to me." The Sultan of Supervision was ready.

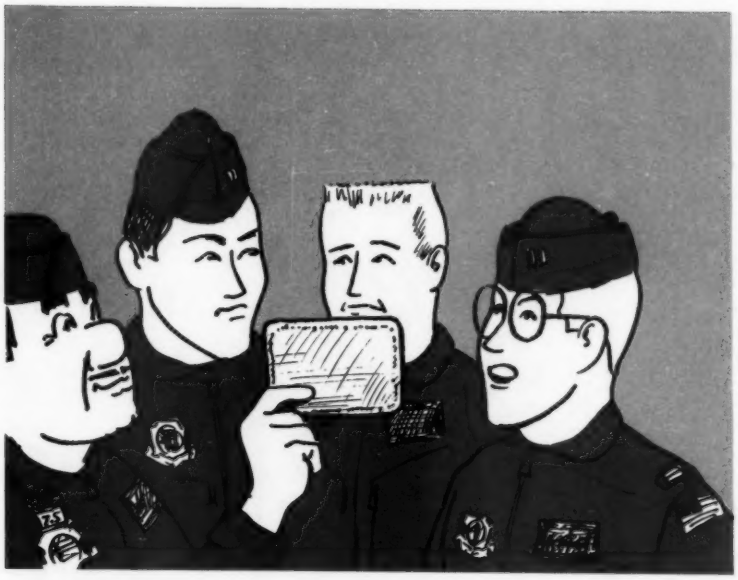
"Okay Sammy, you've got the con. I'm headed to the back," said C.R. as he tossed his headset onto his seat and headed to the ramp. Blinky stepped forward, shook his head and clicked the interphone toggle to "PA."

"Here we go, load," C.R. screeched above the downsped turboprops, and began lowering the ramp. About the time the ramp was parallel with the tarmac, the excitement began. An entourage of ground support personnel literally sprinted toward the ramp, their eyes aglow with the spirit of competition burning brightly. The ramp was still a good 18 inches above terra firma when the first two leaped into the cargo compartment and ran to the nearest parachutes. Waving madly, they positioned their counterparts at the foot of the ramp and began unstrapping the chutes.

"*STOP THE RAMP, BOSS!*" Blinky's voice came booming over the PA, startling the Paunchus Pilot back to consciousness.

"Who, what, who, where. Yes of course," C.R. said as he stopped the ramp, but not before it pinned the steel-toed boot of the closest cargo remover's left foot. Ty sprinted to the back and, in seconds, had the ramp off the injured appendage. "Accepting" control of the operation, Ty quickly had the situation under control, the load secured, and the helpful marshaller, a bit shaken, safely off the aircraft. C.R. "remembered" he needed to review the departure procedures and returned to more comfortable surroundings in the cockpit.

"Boss, we're all *real* lucky. All he lost was the shine off the toe of his boot instead of the toes



off his foot. This is exactly what Capt. MacKenzie was telling us about at the last flight safety meeting," Ty finally ventured after closing the ramp and door.

"I heard Mac has begun a new program of riding with different crews, gathering information and getting a close-up pulse check on how the mission is really being run," Sammy added. He had attended the meeting too.

"Mac? Who's Mac?" C.R. asked, amazed that somebody had spoken at a safety meeting and he hadn't already met him at least twice at the bar.

"He's the numbered Air Force Flight Safety Officer," Max threw in.

"I'll bet he'd have some interesting thoughts on this particular operation," Ty added, still red-faced, sweating and shaking a little. "This whole process could probably have been predicted *and* prevented."

"I think the guy can do a lot for us," Blinky added. "He has a keen insight on the 'why' behind just this kind of affair, and probably many of our other, er, ah, events."

"This guy sounds like one of those groomed, upcoming professional pilots," C.R. intoned. "And frankly, I'm a little tired of hearing about these so-called guppies. With all my experience in the MAC mission, I can't really see the necessity . . ."

"Don't worry, Boss, this command has appreciated your contribution all these years," Sammy began. He noticed the telltale beads of sweat appearing on the Ace Aviator's balding pate, indicative of either a particularly marvelous chili-jalapeno-grits omelet, or the onset of one of the Magnificent Major's rhetorical remembrances.

"Ah, yes, Samuel old bean. I guess it might be me, but flyin's just not the same anymore. I've been kicking around a few ideas." C.R. was strangely pensive. He reached into the pocket of his custom-made flight suit and withdrew a small square piece of parchment. Thrusting it at the Competent Copilot, he murmured a quick "What do you think of this?" and turned his attention back to the mass of enroute charts, IFR supplements, approach plates and flight information handbooks threatening to oust him from the left seat.

"Look at this, guys," Sammy spoke, his voice quivering. He held out the card for the rest of MAC's one and only hard crew. It read:

C.R. TERROR
COMBAT CROP DUSTING
AND
SENSITIVE AIRLIFT, INC.

Along the edge were some jingles reminiscent of the Magic Major's personal flight card. Such advertising catches as: Bugs Bombed; Flies Flogged; Pheromes Fumigated; Termites Torched; Contraband Contracted; and Weapons Wielded. Centered along the bottom edge, in italics, was the phrase on which each of them now focused their gaze: *"You Call, I Haul—31 Years Experience."*

Power and the Remote Approach

A lesson to live by

by Capt. Michael J. Iltis
Associate Editor

For most aviators, the art and science of flying is filled with constants. For instance, most airplanes require a prepared surface to take off and land. Thus, most fixed-wing pilots need not be overly concerned about whether or not there is a stand of trees on the runway centerline. Likewise, there is normally a degree of supervision provided the airplane pilot by air traffic controllers, METRO services, ATIS, and Flight Service, to name a few. These agencies assist aircraft operating into or around landing areas. Therefore, most pilots have easy (and sometimes unrequested) access to weather information, airfield condition reports, and information on conflicting air traffic. Indeed, the emphasis in aviation engineering is to reduce the number of variables with which the crew

must deal (witness inertial navigation systems). This is not to imply that airplane flying is by any means automatic, but the number of variables continues to shrink.

However, in the immortal words of commentator Harry Reasoner, "Helicopter pilots are different." No, I'm not referring to their good looks and sparkling personalities, but rather to the environment they operate from—the remote or unprepared takeoff and landing area.

Time and space considerations won't permit me to detail all the variable intricacies of remote flying, so let's focus on two variables all helicopter crews must deal with: power available, and power required to hover. To do this I'll examine the five primary ingredients, which, combined, give us our all-important power available/required figures: temperature, pressure altitude, gross weight, wind, and ground effect.

Back to Basics. Whether the mission takes the helicopter to flat terrain at sea level, or places it atop a 14,000 foot mountain, *power available* and *power required* to hover constitute the variables which are so important in successful remote operations. If power required exceeds power available, a hard landing is imminent, at best.

One could mistakenly assume that since these two items are numbers extrapolated from the performance charts of a flight manual, they aren't variables. However, a closer look at the ingredients which combine to yield these numbers shows they are.

- **Temperature.** Getting accurate outside air temperature indications is much more difficult than looking at a gauge or even applying the standard lapse rate to a reported field temperature. It also requires the crewmember be aware of the effects of ground heating.

Temperature has the greatest effect on power available/required of any variable. OAT close to the ground may vary significantly from temperature only a few hundred feet above the surface due to localized ground heating and topographical characteristics of the landing or takeoff area.

For instance, your helicopter and crew are tasked to land next to a riverbed in a steep rock canyon with a 1,500 foot vertical rise. At the canyon's rim, the temperature gauge reads 30°C. Using standard lapse rate, the temperature on the riverbed would calculate to around 33°C. What standard lapse rate doesn't account for, however, is the effect of radiant heat off the canyon floor and walls in a no-wind condition. One Air Force crew placed in this situation discovered that the canyon floor temperature was 10-15°C hotter than expected. This equals a 10-15% *reduction* in power available, with an accompanying 2-4% *increase* in power required to hover. Couple this with a high gross weight and marginal power condition and you have all the ingredients for disaster. Not only may power required to *hover* exceed power available, but cruise performance is also limited by reduced power available.

Temperature deviations aren't confined to mountain operations. Areas covered with dense vegetation also produce ground temperatures much higher than the temperature just 200 feet above. Helicopters operating in confined areas surrounded by 200 foot trees, as in the tropical jungles of New Guinea, have experienced temperature increases of up to 10°C between the tops of the trees and ground level. The dense vegetation not only provided a canopy to trap the radiant heat, but also served as a perfect natural wind break, keeping air from circulating through the remote area.

This condition is particularly hazardous since it may go unnoticed until the aircraft has descended below tree level on an approach. In this case, airspeed would drop instantaneously due to the sudden loss of headwind component. This reduction in airspeed could result in the premature loss of translational lift and place the aircraft in an out-of-ground-effect (OGE) hover. The warmer temperatures below tree level both increase power required and decrease power available. At this time, the crew loses the go-around option, unless they *planned* for this power loss by using a power available margin in *excess* of that required for an OGE hover.

Though these examples cite locations that you might not fly to everyday, keep in mind the principles involved apply to any wind-sheltered, confined area. The severity will depend on the extent of ground heating and the height and density of obstacles surrounding the area.

● **Pressure Altitude (PA).** Pressure altitude is the altitude indicated on the altimeter when the barometric scale is set at 29.92 in Hg. As atmospheric pressure increases or decreases, so does PA. Correct PA for temperature, and you have density altitude. As pressure altitude and temperature increase, air becomes thinner and more power is required to hover. If you fly from a low pressure altitude to a high pressure altitude, power required increases. Power available decreases as PA increases because engine performance is partially contingent upon the barometric pressure.

● **Gross Weight.** Unlike temperature, gross weight affects only power required to hover and not power available. Small changes in aircraft gross weight don't impact power required as dramatically as small changes in temperature, but the effect of a gross weight change is directly proportional. As gross weight increases, so does power required to hover. Unfortunately, some operators mistakenly view gross weight as a constant factor over which they have little control, rather than a variable they can manipulate.

Several factors relating to gross weight should be considered prior to committing to a remote area takeoff or landing. First, crewmembers should evaluate whether all of their "mission essential" equipment is necessary. This is especially important for lightlift helicopters where the difference between design gross weight and maximum gross weight is small and cabin space limited. Take a look at your crew complement and passenger manifest. Nonessential personnel on any mission unnecessarily compromise the safety and success of the mission.

The second weight factor is fuel load. Too often, helicopter pilots fall into the "full tanks" syndrome. By all means, make sure required fuel is onboard, but don't let poor planning increase your power required to hover. A 45-minute round-robin mission with an ops stop at a power-critical remote site probably doesn't require three hours of fuel. Finally, if your helicopter has airborne fuel dumping capability, consider using it to reduce gross weight in a power critical situation. To some, this may seem ridiculously obvious but the truth is, all too often mishap investigators walk through yards of fuel drenched ground, the result of excess fuel reserves, when sifting through the remains of a helicopter that just "ran out" of power.

● **Wind.** The variable of variables is wind, or the lack of it. The previous discussion on temperature touched on the deadly results of a sudden loss of headwind component, but what about other considerations? For example, when given a choice between a left-quartering headwind or a right-quartering headwind, which would you choose in a power limited situation? A left-quartering headwind reduces power required to hover because the aircraft naturally weathervanes left (on helicopters with counterclockwise turning rotorblades). This reduces drag, left pedal requirements and, ultimately, power required to hover.

● **Ground Effect.** As the helicopter nears the ground during an approach, the ground begins to interfere with the formation of rotor tip vortices. This increases the efficiency of the outboard portions of the rotor blades. Airflow generated by the rotor blades is interrupted and deflected away from the blades. This phenomenon is called ground effect and it reduces power required to hover.

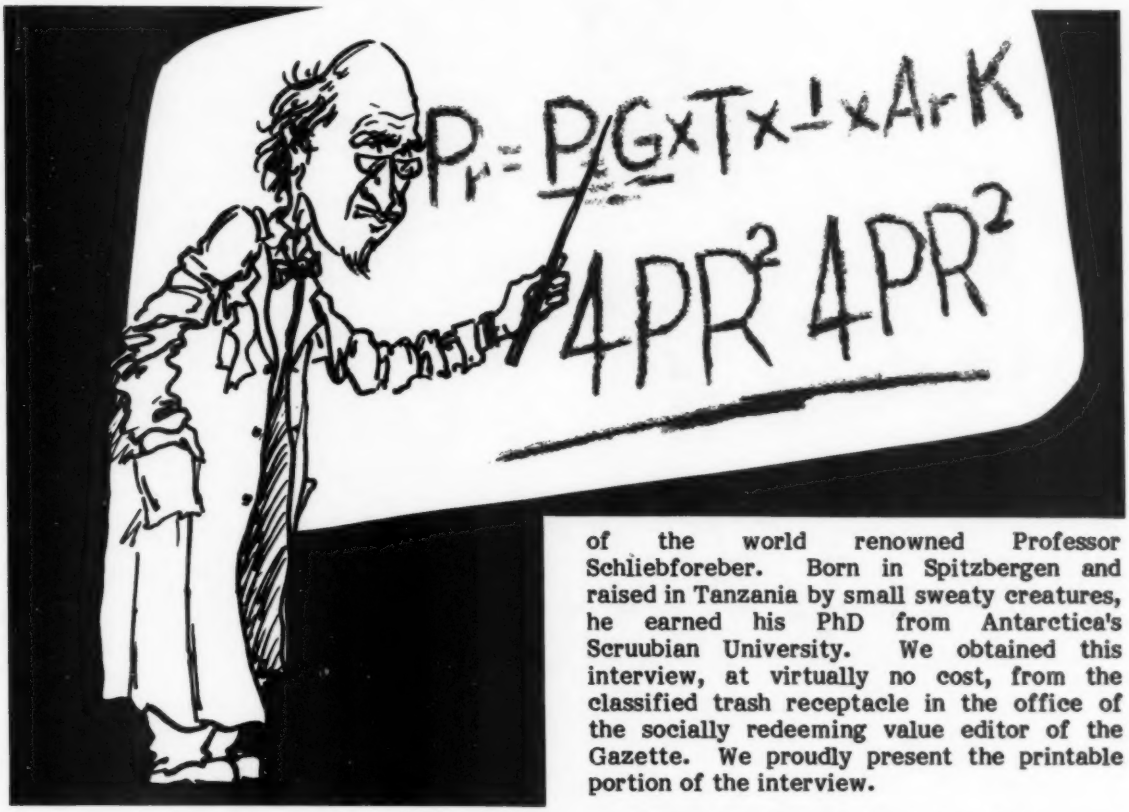
Though this, too, might seem a constant factor, topography and wind vary its nature considerably. If the hover area is a pinnacle or if the surface slopes or is porous, the power-saving advantage of ground effect is reduced or eliminated. Wind will tend to disturb the ground effect airflow pattern from beneath the aircraft, thus reducing its effectiveness. The bottom line: don't play Russian Roulette with ground effect. If you don't have OGE power available, don't fly into a place where you'll need it! In all cases, keep your go-around options open.

The last few columns on power available versus power required only scratched the surface of the many variables associated with helicopter remote operations. Temperature, pressure altitude, gross weight, wind, and ground effect interact to provide accurate power available/required relationships. The good pilot knows these principles, but the great pilot recognizes them, understands their correlation, and applies them to the situation at hand. Safe remote area helicopter operations don't stem from state-of-the-art gadgetry, but from informed, responsible, common-sense flying.

Radio Detection and Ranging Equipment

What they mean to aviators

by Capt. Donald L. Rosenberry
Associate Editor



There's really not much we, as mere mortal aviators, can do to control the weather in which we fly. About the best we can hope for is to know the weather we can expect at takeoff, enroute, and at destination. The goal, of course, is to avoid the worst of the weather (thereby completing missions), support the nation, and extend our fragile mortality a bit. Among the electronic devices man has conceived to assist in this noble endeavor is the RADAR. Because this is a technical subject, we spared no expense bringing in a bonafide expert to clarify the finer details. We were lucky enough to come across an interview conducted by the science editor of the Eucalyptus Daily Gazette (EDG) of the world renowned Professor Schliebforeber. Born in Spitzbergen and raised in Tanzania by small sweaty creatures, he earned his PhD from Antarctica's Scruubian University. We obtained this interview, at virtually no cost, from the classified trash receptacle in the office of the socially redeeming value editor of the Gazette. We proudly present the printable portion of the interview.

EDG: Professor, there has been some question as to the efficacy of retrofitting the entire fleet with the new . . .

Schliepforeber: Good. I begin with the history of this Radio Detection and Ranging device—the RADAR. A radar transmitter emits radio waves at distinct frequencies known as carrier frequencies. The carrier frequency is selected based upon the proposed end use of the device. During WWII, for security reasons, these frequencies were given code letters, some of which persist to this day. Frequencies near 10,000 MegaHertz (mHz) are called X-band; near 3,000 mHz they're called S-band; near 1,000 mHz they're called L-band; near 6,000 mHz they're called C-band, etc. Now . . .

EDG: I see. So the frequency of the radar, combined with the car rental agency of the manufacturer gave us code letters. How quaint. But I fail to see where these letters fall in the radar equation. You know, where P_r = received power; P_t = transmitted power; G = gain of transmitting antenna; T = reflectivity of the target; A_r = effective area of the receiving antenna; R = range; P = pi; and K= atmospheric attenuation to yield the formula: $P_r = \frac{P_t G}{4PR^2} \times T \times \frac{1}{4PR^2} \times A_r K$

right?

Schliepforeber: Are you through? Why is it you science guys always start with numbers and go straight to dry heaves? Nobody really listens to all that verbal vomit anyway. As I was saying, brick-brain, there are various frequencies of radio waves which determine the application of the device. You see, the radar cross section of a target is not constant with frequency. In general, you have three ranges. The target is either smaller, the same size, or larger than the wavelength, with corresponding scattering regions called Rayleigh, Resonant, and Optical, respectively.

EDG: Oh! I get it. You vary the wavelength to determine the size of the object in question. That seems pretty useful all right.

Schliepforeber: It is unfortunate we don't have a device which produces wavelengths short enough to measure the size of your alleged brain. Let me continue or I'll reveal your appreciation for synthetic footwear. Now, as I was saying, the relationships of target size to wavelength are important when selecting a frequency to see through something, like trying to find an aircraft through rain.

EDG: Like focusing a camera on an object through a fence—in the developed photo you can't see the fence at all.

Schliepforeber: I'm flabbergasted, you actually grasped a concept. That must be why you're the science editor. Now, for weather radar, you can see . . .

EDG: Yes Doctor, I *can* see. Why, we could use wavelengths of approximately the same size as the raindrops, making them easily visible on the screen. Why, the possibilities are awesome! Let's do it, Doc. C'mon, I'll say you helped me with the idea a little, the patent can be in both our names. I can see some wonderf . . .

Schliepforeber: Why don't you screw your head on straight and get it out of the clouds? Weather radar, in use since the 1930s, uses wavelengths in the resonant range of water drops, making them easily discernible. Radars using this theory are in use on many aircraft, civilian and military.

EDG: I had hoped to broach this topic. I know some people who fly military aircraft. Do you think it's a good practice for them to use their X-band radars to penetrate thunderstorms?

Schliepforeber: In your case I highly recommend it. In fact, as a contribution to mankind at large, I will even rent an aircraft for your use in the experiment. But for those who like to keep a balance between the number of takeoffs and landings they are witness to—*NO!* The whole point in having a weather radar is to be able to see areas of increased precipitation, representative of thunderstorms and other not-good weather phenomena, the better to avoid them.

EDG: I'm a little confused here. Are you trying to say the X-band radar isn't a good penetration device?

Schliepforeber: A *little*? I'm not trying to tell you anything because your brain is obviously squawking 7700. I portend there are *no* good thunderstorm penetration devices. It's as simple as can be. Civilian and military aircraft aren't designed to enter thunderstorms, and they certainly aren't designed to exit them, that's why so many don't.

EDG: Oh, I get it. Sort of a one-way trip, eh? Then what do you think we should use the radar for?

Schliepforeber: I think I see another application for radar astronomy—spelunkering in your cranial abyss. We use the radar to detect precipitation. Many X-band radars are also capable of detecting differing values of precipitation rates.

EDG: What? They actually charge you for the use of . . .

Schliepforeber: Quiet! It's truly hard to believe such a rudimentary form of nucleus can keep you breathing *and* talking. The differing values I spoke of can be displayed in several ways, the most common forms are contour lines and colors. These radars have some excellent features, they also have some limitations.

EDG: I've always said a man has *got* to know his . . .

Schliepforeber: I think your brain's on/off toggle should be safety wired to the off position to prevent these outbursts. We speak here of *radar* limitations. Let's examine how a radar actually works, to gain insight into these problems. Basically, radio waves are emitted from an antenna, reflected back after striking an object, received by the same antenna, interpreted, and, finally, displayed on the Plan Position Indicator (PPI). Now, there are some refinements, of course.

EDG: Terrific. I love good refreshments.

Schliebforeber: You have totally lost control. Do you follow the Bhagwan? As to those refinements of which I spoke so clearly, consider the early radars. In the original version, radar was monostatic, there had to be separate transmitter and receiver antennas, and there was no way to discern the discrete origination transmission of each resulting signal, and you couldn't figure what from what. One solution was to use pulses .

EDG: Hey! I've got one of those. In fact the Doc said mine is remarkable.

Schliebforeber: Remarkable because your existence as a life form at all is at once questionable and remarkable. If I may continue. The introduction of pulse modulation allowed for the "marking" of transmitted signals for later discernment, and helped with the power production capability.

EDG: Kind of like the electricity you use in your flashlight, eh?

Schliepforeber: A pulse might also be described as a short, high-powered burst, and I'm going to demonstrate one with this here schtick if you keep interrupting me. A side benefit to the pulse modulation concept is it requires only one antenna, which keeps our aircraft looking normal. The main advantage, though, is the identification of reflected pulse from the transmitted signal. This way we can figure out a few things.

EDG: Like range? We just time the signal from transmission to reception and calculate range, right?

Schliepforeber: Almost, Meatface. There's one further complication, though. Say your transmission repetition rate is, oh, 2,000 pulses per second. Even you can see the pulse interval would then be 500 microseconds. Now, if return signals arrive 100 microseconds after each pulse transmission, the target could be 100 microseconds away, 600 microseconds away, etc.

EDG: Like, that seems to be a real problem there, Doc.

Schliepforeber: There is a fix. We simply select a pulse frequency based on the maximum range the scope will detect. For example, if the radar scope is set so the most distant target to be detected is 50 miles away, then the pulse repetition frequency must be greater than that distance translated into microseconds (since radio waves travel at the speed of light this can be easily done via abacus or like device).

EDG: Well then. I'd say the problems with radar are pretty much solved. Thank you, Doc . . .

Schliebforeber: I'm not finished yet, Moosebreath. There are a couple more problems, one of which is attenuation, or the degree to which the radar signal is weakened after transmission by any of a large number of factors, most notably precipitation itself.

EDG: But I thought you've been saying the radar is used to detect precipitation?

Schliepforeber: Bingo, Bonzo. The radio waves, at the appropriate frequency, pick up the rain because they are reflected off it. But just as one wouldn't expect to be able to see through a mountain, you're not going to see through the rain, either. This presents considerable difficulty if aircrews are trying to pick their way through "isolated" thunderstorms imbedded in a solid deck of clouds. It is even worse when the aerial platform carrying the radar is encountering precipitation, also if aircraft are flying through rain. This radio wave stuff is a two way street. Even though the wave may make it out of the radome, the weaker reflected pulse may not. In fact, if there's a buildup of water of roughly ½ inch, the screen is going to be useless.

EDG: Why is that such a big deal? All you have to do is keep track of how much water you have on your nose radome, and keep it from building up. You know, kick the rudders or whatever.

Schliepforeber: You are amazing! The chemical you're on is surely not for general consumption I hope. The problem is insidious, and can sneak up on you, too. Most aircraft aren't equipped with a nose radome waterometer, and usually the screen depiction will give the impression it's working, even when it isn't. This makes in-flight testing very important. Even if the internal workings are okay, though, it doesn't mean you're okay.

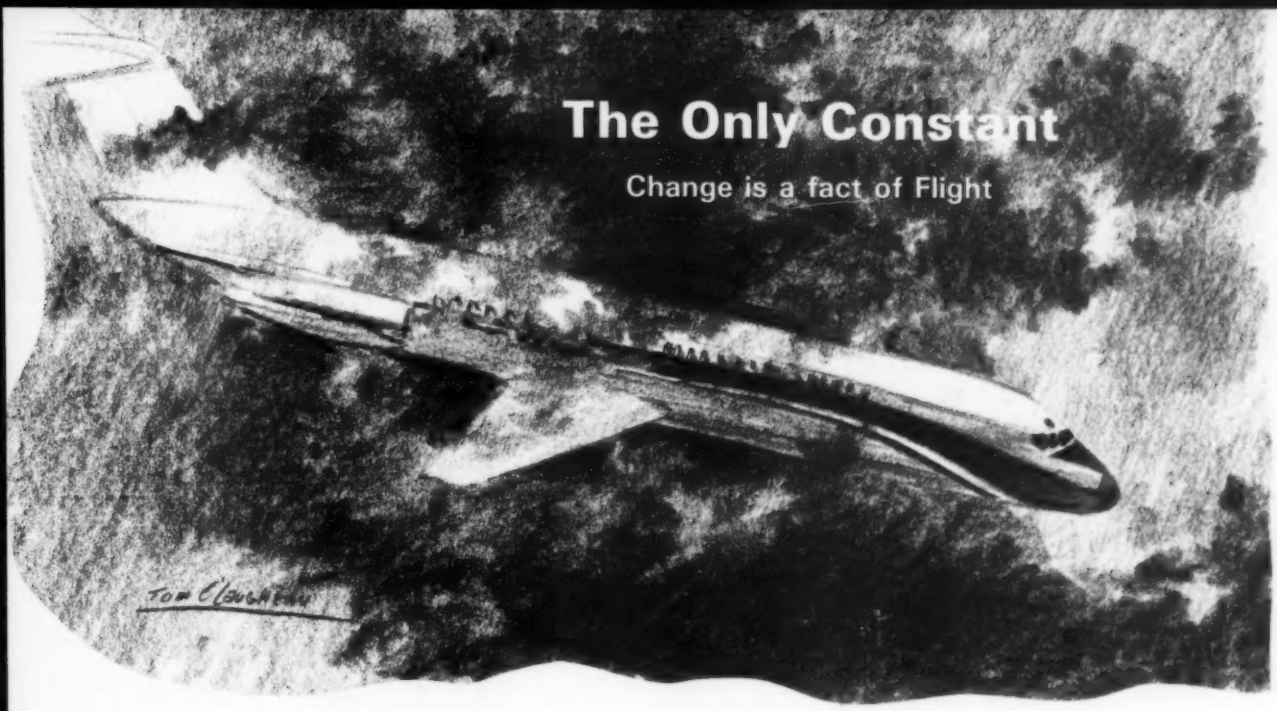
EDG: What? Then why even have the test function?

Schliepforeber: I'm okay. You are grossly abnormal. The proper test in flight entails altering the tilt to determine if ground returns are still making it back to the antenna, preferably by turning the tilt down. But you have to remember the attenuation isn't static, it gets worse or better with the change in precipitation rate.

EDG: Sounds like you're done for if you have to fly wet.

Schliepforeber: With your drooling difficulties, that's a permanent state for you, but for professional aircrews there are options. Keeping our discussion of frequencies in mind, remember that ground-based weather radar operators use different frequencies than you use with your airborne radar. They can see that which you can't. Their radar isn't any more accurate, they simply have the luxury of being able to use larger equipment with varying frequencies, so give them a call.

EDG: Thank you, Doctor Schliepforeber. I plan to run this article in tomorrow's Gazette, if it makes it through our coordination process. Have a nice day, eh.



The Only Constant

Change is a fact of Flight

by Maj. Thomas C. Weinzierl
Supervising Editor

It was a typical summer afternoon as the crew of a twin-engined trainer began their descent to a northern plains airbase after a flight from the Southwest U.S. Thunderstorms dotted the sky to the south/southwest of their position, providing an ominous backdrop to their approach, but the cloud layer from FL 350 to FL 250 presented no more challenge than the opportunity to spend some time "on the gauges."

After an uneventful approach and landing, the second-in-command contacted weather and relayed the update, "no change, isolated thunderstorms in the area." After slightly less than an hour on the ground, they departed on essentially the same groundtrack they flew during the descent and approach. This time, however, things were a little different. The airplane entered the clouds at FL 250, but climbing through FL 310, entered what appeared to be heavy precipitation. After landing, the crew discovered extensive hail damage to the wings, vertical stabilizer, and nose cone. The hail was most probably generated by a nearby thunderstorm.

Obviously, the weather situation *had* changed. The thunderstorms intensified and moved to an area directly south of the base. However, due to their short ground time, the crew didn't take the time to get *detailed* weather information. More complete weather information was available.

All crewmembers have to deal with myriad situations, both on the ground and in the air. Most are fairly predictable. We know what to expect and how we are going to respond. The same applies to our aircraft. We know how our aircraft operates, how it will perform under various conditions, and what to expect if any "normal" emergency pops up.

However, circumstances can change rapidly, especially when weather is a factor. There are few professions where human beings willingly venture into such a harsh and unforgiving environment—an environment capable of generating incredibly destructive forces. Weather may be the most dynamic factor aviators must face while performing their job. The results of assuming stable weather conditions, even over a short period of time, were tragically demonstrated in an accident involving a civilian DC-9. Just

before 1600 EST on April 4, 1977, Flight 222 was preparing to depart Huntsville, Alabama, for the second shuttle of the day to Atlanta, Georgia, with 81 passengers and four crewmembers aboard. The crew had received weather forecasts for selected stations along their route from Muscle Shoals, Alabama, through Huntsville to Atlanta. The dispatcher at Muscle Shoals relayed two tornado watches and two SIGMETs that called for scattered to numerous thunderstorms with hail, high winds, and cloud tops between 40,000 and 58,000 feet over northern Alabama and Georgia. These forecasts were prepared earlier that morning, before the flight left Muscle Shoals, and neither the airline nor the crew took any action to update the forecasts throughout the day. However, things didn't look too bad during the leg from Atlanta to Huntsville two hours earlier; the crew saw the expected afternoon scattered cumulus clouds—tops about 19,000 feet.

The flight was cleared from Huntsville to Rome, with a profile descent into Hartsfield-Atlanta International. The first officer made the takeoff at 1554 EST and the captain contacted departure control. Huntsville Departure gave the crew vectors around a restricted area, cleared them direct to the Rome VOR and handed them off to Atlanta Center. The captain used on-board radar to pick his way through the rainshowers. The airliner was cruising in the clouds at 17,000 feet and encountered turbulence, so the captain directed the first officer to decrease airspeed.

The 1600 weather report from Rome included "thunderstorms, light rainshowers, continuous thunder southwest through northwest." A tornado moved from southwest to northeast near the Rome VOR. At 1601, the Athens, Georgia, weather station reported a group of thunderstorm cells centered 15 miles west of Rome; the tops of the cells were over 51,000 feet. Though all of these conditions were forecast earlier in the day, the flight crew was unaware of them because they never updated their original weather information.

As Flight 222 approached the storms, heavy rain and hail pelted the airplane. A passenger saw lightning strike the left wingtip. The first officer stated, "I don't know how we're going to get through here."

"I know," the captain responded. "We're just going to have to go out the best way we can." Looking at the radar scope he spotted what looked like a hole between the thunderstorms and told the copilot to fly the airliner through it.

What looked like a hole really turned out to be an intense part of the storm. The heavy rainfall and hail had attenuated the radar presentation to the point that the worst part of the storm looked like a hole.

Penetration of the storm resulted in dual engine failure and an attempted landing on a highway. Of the 85 people on board, 62 died in the crash and ensuing fire.

"... the most severe storm... in the US in the last three years."

Flight 222 encountered what the National Weather Service later described as ". . . the most severe storm . . . in the U.S. in the last three years."

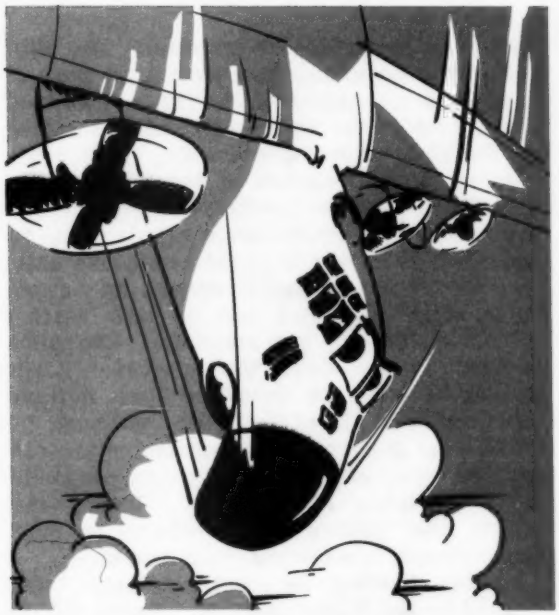
The NTSB determined the probable cause of the accident was ". . . the total and unique loss of thrust from both engines while the aircraft was penetrating an area of severe thunderstorms . . . caused by the ingestion of massive amounts of water and hail, which in combination with thrust lever movement, induced severe stalling in and major damage to the engine compressors."

One board member dissented, ". . . I would state the probable cause as the captain's decision to penetrate rather than avoid an area of severe weather, failure to obtain all available weather information despite having prior knowledge of its severity, and reliance on airborne radar for penetration rather than avoidance . . ."

MAC aircrews fly in every type of weather imaginable and as these mishaps graphically illustrate, nothing, especially the weather, is ever "the same as last time."

Remember, the only constant . . . is change.

MURPHY STRIKES AGAIN



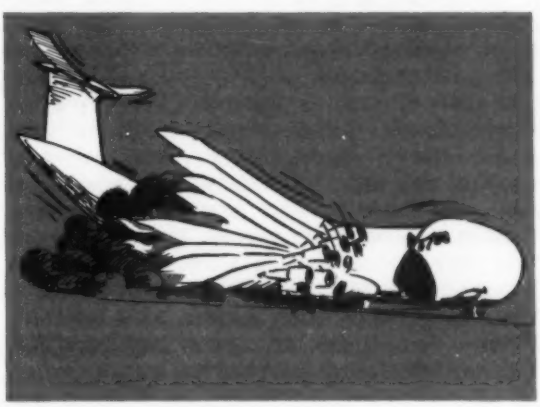
The heroic Herk honcho's trouble began shortly after he smoothly rotated his four-fanned flyer. He noticed more than normal resistance to control movement and appropriately elected to trim nose-up. As the aircraft became airborne and continued to accelerate, control pressures were still heavy. A second application of "nose-up" trim produced a nose-down pitch attitude. With about six thousand feet of runway remaining and 40 ft AGL, the AC elected to put the aircraft back on the ground.

Investigation revealed the pilot's trim tab control switch was installed backwards.

A lot of people could take credit for this one. The designer of the switch, for designing it so it could be installed backwards; several maintenance technicians, for not catching the improper elevator movement during operational checks; and two flight engineers for not catching the improper movement during two separate pre-flights. C'mon guys.

BEARING BREAKDOWN

The stalwart crew of the C-5 landed their awesome airlifter during a local training mission to remedy an intermittent left bleed duct hot indication. After parking, the crew noticed the number-two engine low oil pressure light flash on. The scanner confirmed an oil leak on number-two, so the IP called for the visible fluids checklist. The base firefighters were standing by as the crew completed the checklist and shut down the engine. The firemen had a chance to use their training when pooled oil in the tailpipe ignited. Fire damage to the engine was minimal, but the pylon was scorched. The fire delaminated some of the pylon's honeycomb. Seems the number-five roller bearing cage failed, resulting in failure of the bearing itself. The C-sump filter screens were clogged by pieces of the bearing and oil was blown back into the hot section of the engine which caused the fire. The oil ignited when the engine was shut down. Watch those lights, folks; they're trying to tell you something.



Quick Stoppers

TORPEDO SINKS LOADMASTER

While checking the aircraft's cargo load, the C-141 loadmaster discovered a reddish-orange fluid leaking from one of 12 torpedoes in pallet positions one through three. The loadmaster had been told by the departure base ATOC the torpedoes were inert and contained no hazardous material. The pilot called the departure base command post to determine the nature of the fluid. This took some time so the loadmaster started wiping up the fluid with paper towels. During the cleanup, a small amount of the liquid came in contact with the loadmaster's hands. The loadmaster also inhaled some vapors which he described as having "a sweet smell, like anti-freeze." The loadmaster donned an oxygen mask after the pilot had no luck getting ATOC to identify the material. The pilot decided to air abort the mission. After landing back at the departure base, a Navy representative identified the material as OTTO Fuel II and told the loadmaster to wash exposed areas with warm water and soap. He didn't elaborate any further. During the return the loadmaster developed a mild headache and experienced mild nausea.

After landing he was examined and cleared by the flight surgeon. Though OTTO Fuel II is not specifically identified as a hazardous material in AFR 71-4, it is toxic. The main point of this episode is clear. Any unknown substance should be considered hazardous—act accordingly.

LIGHTNING LASHES A LEAR

While cruising at FL 390 in their trusty twin-engined T-tailed transport, the C-21 crew observed some ominous radar returns 200 miles ahead and slightly south of course. The crew elected to climb to FL 430 to avoid cirrus clouds. Later, about 30 NM north of some heavy precipitation, the aircraft encountered light to moderate turbulence as well as three to four minutes of lightning flashes. During this period, the number-one VHF Nav system and Data Nav system failed. After landing, the crew discovered damage to the radome apparently caused by a lightning strike. Sometimes, no matter how hard you try, Mother Nature still has her way.

After Deadlines

AIR FORCE RESERVES ASSIST COLOMBIAN RELIEF EFFORT—C-130 aircraft and aircrews from the 302d Tactical Airlift Wing based at Peterson AFB, Colorado, were the first to ferry relief supplies to the volcano-devastated Colombian town of Armero. Armero, an agricultural center located 70 miles northwest of Bogota, Colombia, was virtually wiped off the map when a volcano, dormant for more than four centuries, erupted, sending a wall of mud and water into the town of 20,000 residents. The 731st Tactical Airlift Squadron, one of three squadrons under the 302d TAW, transported 1,400 tents used to provide temporary shelter for the homeless along with medical and helicopter supplies and fuel. The Reservists were on a scheduled deployment to Howard Air Base, Panama, when the call for help came from the Colombian government.

NEW PRESIDENTIAL AIRCRAFT—The Air Force is replacing the two vintage Air Force One aircraft used by the President with two new jets. According to Aeronautical Systems Division officials, contracts for the new aircraft should be awarded in May for the first aircraft, which will probably be delivered in late 1988. The second aircraft would be delivered in 1989. Officials said the new aircraft were needed primarily because the present aircraft are difficult to maintain and support and do not meet standards and performance limitations set by the Federal Aviation Administration.

OOPS!—You eagle-eyed perusers of this tabloid did it again! In the December issue of *The MAC Flyer*, question #1 of the instrument quiz on page 18, *your* copilot, Smedley, asked *you* what the funny looking "T" at the bottom of the approach plate meant. *You* incorrectly told him it indicated that take-off minimums aren't standard, and/or departure procedures *aren't* published. Everyone knows you will see this symbol anytime that departure procedures *are* published. Shame on you! Don't do that again.

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Touch 'n Go

Just Relax, I'll Lead